1988

CHEMISTRY

YEAR 11

TRIAL EXAM

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX (03) 9817 4334

email: chemas@vicnet.net.au

Internet: http://www.vicnet.net.au/~chemas/education.htm

CANDIDATE'S NAME_____

CHEMISTRY ASSOCIATES

YEAR 11 CHEMISTRY TRIAL EXAMINATION 1988

(not to be used before Monday August 1, 1988)

Time allowed for examination = 2.5 hours.

MULTIPLE CHOICE ANSWER SHEET SECTION A

Instructions:(1) Mark letters with a single pencil line

EXAMPLE A ~~B~~ C D

(2) Completely erase any mistakes.

(3) One and only one letter should be marked for each item.

(1)	A	B	C	D	(16)	A	B	C	D
(2)	A	B	C	D	(17)	A	B	C	D
(3)	A	B	C	D	(18)	A	B	C	D
(4)	A	B	C	D	(19)	A	B	C	D
(5)	A	B	C	D	(20)	A	B	C	D
(6)	A	B	C	D	(21)	A	B	C	D
(7)	A	B	C	D	(22)	A	B	C	D
(8)	A	B	C	D	(23)	A	B	C	D
(9)	A	B	C	D	(24)	A	B	C	D
(10)	A	B	C	D	(25)	A	B	C	D
(11)	A	B	C	D	(26)	A	B	C	D
(12)	A	B	C	D	(27)	A	B	C	D
(13)	A	B	C	D	(28)	A	B	C	D
(14)	A	B	C	D	(29)	A	B	C	D
(15)	A	B	C	D	(30)	A	B	C	D

DETACH THIS ANSWER SHEET AT THE START OF THE EXAMINATION

CHEMISTRY ASSOCIATES CANDIDATE'S NAME _____
YEAR 11 CHEMISTRY TRIAL EXAMINATION 1988
Time allowed for examination = 2.5 hours

Structure of examination paper: Number of booklets = 1
Number of Sections = 2

SECTION	NUMBER OF QUESTIONS	NUMBER OF QUESTIONS TO BE ANSWERED	PERCENTAGE OF EXAMINATION
A	30	30	30
B	12	12	70

There is a Multiple Choice Answer Sheet attached to the front of this booklet.

DIRECTIONS TO CANDIDATES
(1) Answer ALL questions.

(2) Section A questions must be answered on the Multiple Choice Answer Sheet provided.

(3) Section B questions must be answered in the spaces provided.

(4) At the end of the examination, place the Multiple Choice Answer Sheet inside the back cover of this booklet and hand them in.

(5) Please ensure that you write your name on this booklet AND on the Multiple Choice Answer Sheet.

(6) Approved calculators may be used.

SPECIFIC INSTRUCTIONS FOR SECTION A

(1) Section A consists of 30 multiple choice items and is worth 30 marks and therefore 30% of the total marks available for this examination. You should therefore spend about 45 minutes on Section A.
(2) Choose the response you consider is correct or best, and mark your choice on the Multiple Choice Answer Sheet according to the instructions on that sheet.
(3) A correctly answered item scores 1, an incorrect item scores 0. No credit will be given for an item if two or more letters are marked for that item. Marks will NOT be deducted for incorrect answers and you are urged to attempt every item.
(4) Jottings should be done in the WORKING SPACES in this booklet.

Item 1
The fundamental particles found in the nucleus of the atom are
A. protons only.
B. neutrons only.
C. protons and neutrons.
D. electrons and neutrons.

Item 2
An atom becomes a POSITIVE ion when
A. its atomic number changes.
B. its mass number changes.
C. it gains protons.
D. it loses electrons.

Item 3
The electronic configuration of the ion , O^{2-}, is
A. $1s^2\ 2s^2\ 2p^6$
B. $1s^2\ 2s^2\ 2p^6\ 3s^1$
C. $1s^2\ 2s^2\ 2p^2$
D. $1s^2\ 2s^2\ 2p^4$

Item 4
The Pauli Principle states that
A. orbitals must have either 1 or 2 electrons.
B. orbitals may have up to 2 electrons.
C. orbitals must contain 2 electrons.
D. orbitals must follow the octet rule.

Item 5
A PERIOD in the period table is identified as
A. a row of the periodic table.
B. a column of the periodic table.
C. elements with the same electronegativity.
D. elements with different numbers of valence electrons.

Item 6
Elements in different groups of the periodic table (e.g. sodium and chlorine) generally have different chemical properties because
A. they have different numbers of outershell electrons.
B. they have different shells as their outershell.
C. they have atoms that are different in size.
D. they have different mass numbers.

Item 7
Ionic bonding involves
A. a sharing of electrons between a metal and a non-metal.
B. a sharing of electrons between two non-metals.
C. a transfer of electrons between two non-metals.
D. a transfer of electrons between a metal and a non-metal.

Item 8
The main type of force holding atoms together in molecules is
A. nuclear.
B. gravitational.
C. electrostatic.
D. magnetic.

Item 9
The most important types of chemical bonding present in a sample of ammonia gas dissolved in water are
A. covalent bonding and hydrogen bonding.
B. ionic bonding and hydrogen bonding.
C. ionic bonding and covalent bonding.
D. covalent bonding and dispersion forces.

Item 10
Metal M forms a compound with the formula MSO_4. Which one of the following formulae is correct?
A. MCl
B. MOH
C. MCO_3
D. MNO_3

Item 11
Which one of the following is NOT an empirical formula?
A. C_3H_8
B. H_2SO_4
C. H_3PO_4
D. $C_6H_{12}O_6$

Item 12

The elements carbon and hydrogen make up a compound. 50 g of this compound contains 40 g of carbon and 10 g of hydrogen. Given that the relative atomic masses of carbon and hydrogen are 12 and 1 respectively, the empirical formula of this compound is

A. CH
B. CH_2
C. CH_3
D. CH_4

Item 13

In one mole of $Ca_3(PO_4)_2$ there is

A. one mole of calcium atoms.
B. four mole of oxygen atoms.
C. four mole of phosphorus atoms.
D. eight mole of oxygen atoms.

Item 14

Three molecules of urea, $CO(NH_2)_2$, contain a total of

A. 5 atoms.
B. 8 atoms.
C. 15 atoms
D. 24 atoms.

Item 15

The molar mass of $Ca_3(PO_4)_2$ is (O = 16 , P = 31, Ca = 40)

A. 199.
B. 279.
C. 310.
D. 430.

Item 16

If one mole of nitrogen atoms contains 6×10^{23} nitrogen atoms, then the number of molecules of nitrogen in one mole of nitrogen atoms is

A. 3×10^{23}
B. 6×10^{23}
C. 12×10^{23}
D. 18×10^{23}

Item 17

A solution of iron(III) nitrate, $Fe(NO_3)_3$, contains

A. equal numbers of iron and nitrate ions.
B. twice as many nitrate ions as iron ions.
C. three times as many nitrate ions as iron ions.
D. nine times as many nitrate ions as iron ions.

Item 18

The molar mass of hydrated copper(II) sulfate, $CuSO_4.5H_2O$, is

(H = 1, O = 16, S = 32, Cu = 63.5)

A. 177.5
B. 185.5
C. 201.5
D. 249.5

Item 19

If one mole of oxygen atoms has a mass of 16 g, what mass of oxygen molecules is there in 16 g of oxygen atoms? (Oxygen molecules are diatomic, O_2, and the relative atomic mass of oxygen = 16)

A. 8 g
B. 16 g
C. 32 g
D. 64 g

Item 20

A gas occupies 6.0 dm^3 at 25^oC and 120000 Pa. At STP this volume would be

A. (120000/101325) x (273/298) x (1/6) dm^3
B. (120000/101325) x (298/273) x 6 dm^3
C. (120000/101325) x (298/273) x (1/6) dm^3
D. (120000/101325) x (273/298) x 6 dm^3

Item 21

5 g of sodium hydroxide is dissolved in 5 dm^3 of water. The molarity of the hydroxide ion in solution is approximately

(Molar mass of NaOH = 40 g mol^{-1})

A. 0.025 M
B. 0.25 M
C. 1.00 M
D. 10.00 M

Item 22

A base would best be described as

A. a proton donor.
B. a proton acceptor.
C. an electron donor.
D. an electron acceptor.

Item 23
Which one of the following is a conjugate acid-base pair?

A. HNO_3 and NO_3^-

B. H_3O^+ and OH^-

C. HNO_3 and H_2O

D. NH_3 and OH^-

Item 24
The AVERAGE oxidation number of carbon in sucrose, $C_{12}H_{22}O_{11}$, is

A. -1
B. 0
C. +1
D. +2

Item 25
Which one of the following reactions represents a REDOX reaction?

A. $Al(OH)_3 + 3HCl = AlCl_3 + 3H_2O$

B. $CaCO_3 = CaO + CO_2$

C. $Ag^+ + Cl^- = AgCl$

D. $Zn + 2H^+ = Zn^{2+} + H_2$

Item 26
Ammonia reacts with oxygen to produce nitrogen monoxide and water according to the equation:

$$x\,NH_3 + y\,O_2 = z\,NO + w\,H_2O$$

The values of x , y , z and w which will balance this equation are respectively

A. 2 , 2 , 2 , 3.
B. 3 , 4 , 3 , 4
C. 4 , 5 , 4 , 6
D. 5 , 6 , 5 , 7

Item 27
The balanced equation for the reaction between aluminium hydroxide and hydrochloric acid is

A. $Al(OH)_3 + 3HCl = AlCl_3 + 3H_2O$

B. $AlOH + HCl = AlCl + H_2O$

C. $Al(OH)_3 + H_2Cl = AlCl + 5H_2O$

D. $AlOH + HCl_2 = AlCl_2 + H_2O$

Item 28
The chemical formulae for propane and butane are respectively:
A. C_2H_6 and C_3H_8
B. C_3H_8 and C_4H_{10}
C. C_3H_6 and C_4H_8
D. C_2H_6 and C_4H_{10}

Item 29
When one mole of ethane gas reacts completely with oxygen gas, the products are
A. 1 mole of carbon dioxide and 1 mole of water.
B. 1 mole of carbon dioxide and 2 mole of water.
C. 2 mole of carbon dioxide and 3 mole of water.
D. 2 mole of carbon dioxide and 4 mole of water.

Item 30
The number of structural isomers of the substituted alkane, $C_3H_5Cl_3$, is
A. 4
B. 5
C. 6
D. 7

END OF SECTION A

SPECIFIC INSTRUCTIONS FOR SECTION B

(1) Section B consists of 12 questions and is worth 70 marks and therefore 70% of the total marks available for the examination. You should therefore spend about 105 minutes on Section B. A suggested time allocation is given for each question and the marks allotted to each question are also indicated.
(2) Answers must be written in the spaces following each question in this booklet.
(3) You should show all working in numerical questions. No credit can be given for incorrect answers unless they are accompanied by details of the working.
(4) Full credit will not be given for unsimplified answers. When stating an answer, appropriate precision (number of significant figures) must be used and the units included.
(5) When chemical symbols are used in equations they must be accompanied by correct symbols of state, for example $H_2(g)$ for hydrogen gas.

QUESTION 1 (9 minutes, 6 marks)

Write balanced chemical equations for each of the following:

(a) silver nitrate solution is added to sodium chloride solution and a precipitate forms.

_____

(b) ethylene gas (C_2H_4) burns in oxygen gas to produce carbon dioxide gas and water vapour.

_____

(c) the addition of manganese dioxide catalyst to an aqueous solution of hydrogen peroxide produces oxygen gas and water liquid.

_____

(d) dilute sulfuric acid is neutralised by sodium hydroxide solution.

_____

(e) write the IONIC EQUATION for the reaction in (d)

_____

(f) write the IONIC EQUATION for the reaction in (a)

_____

QUESTION 2 (7 minutes, 5 marks)
Name the following compounds:

(a) Na_2SO_3_____ (f) HgI_2 _____

(b) KNO_3_____(g) $K_2Cr_2O_7$_____

(c) $FeSO_4$_____(h) $KMnO_4$_____

(d) $KClO_3$_____(i) C_2H_5OH_____

(e) NaOCl_____(j) H_2S_____

QUESTION 3 (7 minutes, 5 marks)
The element silver occurs as two isotopes. The isotope with a relative mass of 106.9 has an abundance of 51.8%. The other isotope has a relative mass of 108.9
Calculate the relative atomic mass of silver.

QUESTION 4 (8 minutes, 5 marks)
Write the electronic configuration of each of the following:

(a) H _____ (b) Ne_____

(c) Ar_____(d) Ca_____

(e) Na^+_____(f) Cl^- _____

(g) Mg^{2+}_____(h) O^{2-}_____

(i) N_____(j) H^+ _____

QUESTION 5 (11 minutes, 7 marks)
Write a brief account of the history of the development of the Periodic Table. You must include the contribution of Mendeleev to this development.

QUESTION 6 (11 minutes, 7 marks)

(a) Describe with the aid of diagrams, the INTRAMOLECULAR and INTERMOLECULAR bonding in ammonia gas.

(b) Draw the structures of the following molecules and describe the shape of each.

(1) HF (2) H_2O (3) H_2S (4) CH_4

Indicate clearly whether the molecules are POLAR or NON-POLAR.

QUESTION 7 (6 minutes, 4 marks)

A liquid is found to contain 52% carbon by mass and 13% hydrogen by mass. The only other element in the liquid is oxygen. Calculate the empirical formula of the liquid, assuming that it is a pure substance.
(C = 12, H = 1, O = 16)

QUESTION 8 (12 minutes, 8 marks)
Copper metal reacts with 8M nitric acid to produce nitrogen monoxide gas according to the equation:

$$3Cu(s) + 8HNO_3(aq) = 3Cu(NO_3)_2(aq) + 2NO(g) + 4H_2O(l)$$

(a) What volume of 8M nitric acid would be required to react exactly with 2.0 g of copper according to the above equation? (Cu = 63.5)

(b) What volume of nitrogen monoxide gas at STP would be produced in this reaction? ($R = 8.31\ J\ K^{-1}\ mol^{-1}$)

(c) Explain why this reaction is an oxidation-reduction reaction.

_____

_____

_____

_____

_____

QUESTION 9 (9 minutes, 6 marks)

Two flasks are connected by a valve. Flask A contains 10.00 dm^3 of hydrogen gas at a pressure of 1×10^6 Pa. Flask B contains 5.00 dm^3 of helium gas at a pressure of 5×10^5 Pa. The temperature is 100 K.

(a) Calculate the pressure in flask B when the contents of flask A are pumped into flask B.
(Assume that the temperature remains constant).

(b) Calculate the pressure in flask A when the contents of flask B are pumped into flask A and the temperature is doubled to 200 K.

QUESTION 10 (9 minutes, 6 marks)
In each of the following reactions, state whether the first named chemical is acting as an ACID , a BASE or NEITHER. Give a reason for your answer in each case.

(a) $NH_3 + H_2O = NH_4^+ + OH^-$ _____

_____

(b) $K + H_2O = KOH + (1/2)H_2$ _____

_____

(c) $H_2PO_4^- + H_2O = HPO_4^{2-} + H_3O^+$ _____

_____

(d) $2H^+ + Zn = Zn^{2+} + H_2$ _____

_____

(e) $H_2O + H_2CO_3 = H_3O^+ + HCO_3^-$ _____

_____

(f) $AgNO_3 + NaCl = AgCl + NaNO_3$ _____

_____

QUESTION 11 (7 minutes, 5 marks)
Calculate the oxidation numbers of SULFUR and CARBON in the following:

(a) H_2S _____

(b) H_2SO_4_____

(c) Na_2SO_3_____

(d) S_8_____

(e) SO_3_____

(f) CO_____

(g) CH_4_____

(h) CO_2_____

(i) C_2H_6_____

(j) CH_3COOH_____

QUESTION 12 (9 minutes, 6 marks)

(a) The electronic configuration of a carbon atom is _____.

(b) An example of an homologous series is _____

_____

(c) Draw the valence structures of

(1) ETHANE (2) PROPANE (3) n-BUTANE

(d) Draw the valence structures of each of the following.
An example of a carbon compound with:

(1) four single covalent bonds.

(2) four single covalent bonds and one double covalent bond.

(3) two double covalent bonds.

(4) two single covalent bonds and one triple covalent bond.

END OF 1988 CHEMISTRY YEAR 11 TRIAL EXAM

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX: (03) 9817 4334

YEAR 11 TRIAL EXAM 1988 SUGGESTED SOLUTIONS

SECTION A 1C 2D 3A 4B 5A 6A 7D 8C 9A 10C 11D 12C 13D 14D 15C 16A 17C 18D 19B 20D 21A 22B 23A 24B 25D 26C 27A 28B 29C 30C

SECTION B

1. (a) $AgNO_3(aq) + NaCl(aq) = AgCl(s) + NaNO_3(aq)$

(b) $C_2H_4(g) + 3O_2(g) = 2CO_2(g) + 2H_2O(g)$

(c) $2H_2O_2(l) = 2H_2O(l) + O_2(g)$

(d) $H_2SO_4(aq) + 2NaOH(aq) = Na_2SO_4(aq) + 2H_2O(l)$

(e) $H^+(aq) + OH^-(aq) = H_2O(l)$

(f) $Ag^+(aq) + Cl^-(aq) = AgCl(s)$

2. (a) sodium sulfite (b) potassium nitrate (c) iron(II) sulfate
(d) potassium chlorate (e) sodium hypochlorite (f) mercury(II) iodide
(g) potassium dichromate (h) potassium permanganate
(i) ethanol (ethyl alcohol) (j) hydrogen sulfide

3. Relative Atomic Mass = (51.8/100) x 106.9 + (48.2/100) x 108.9
= (5537.42 + 5248.98)/100
= 107.9
= 108 (3 significant figures)

4. (a) $1s^1$ (b) $1s^2\ 2s^2\ 2p^6$ (c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
(d) $1s^2\ 2s^2\ 2p^6\ 3s^2$ (e) $1s^2\ 2s^2\ 2p^6$ (f) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
(g) $1s^2\ 2s^2\ 2p^6$ (h) $1s^2\ 2s^2\ 2p^6$ (i) $1s^2\ 2s^2\ 2p^3$ (j) no electrons

5. The Periodic Table is an attempt to classify the elements according to their physical and chemical properties. DOBEREINER discovered triads of chemically similar elements in which the relative atomic mass of the middle element was the average of the other two. NEWLANDS arranged the known elements in order of increasing atomic weight (relative atomic mass) and claimed that chemically similar elements occurred every eighth element (Law of Octaves). MENDELEEV proposed the Periodic Law:"The properties of the elements are a periodic function of atomic weight". He arranged the elements in a table, left spaces for elements yet to be discovered and predicted the properties of some of these elements. In the modern periodic table, atomic number has replaced atomic weight in Mendeleev's Periodic Law.

6. (a) ammonia gas:
Intermolecular bonding is covalent bonding.
Intramolecular bonding is hydrogen bonding and dispersion forces

6.(b) (1) linear , polar

(2) V-shaped , polar

(3) V-shaped, polar

(4) tetrahedral, non-polar

7. n(C) : n(H) : n(O) = (52/12) : (13/1) : (35/16) = 4.33 : 13 : 2.19

Simplest whole number ratio = 2 : 6 : 1

Hence, empirical formula is C_2H_6O

8. (a) $n(HNO_3)$ = (8/3) x n(Cu) = (8/3) x (2.0/63.5)

$V(HNO_3)$ = n/c = (8/3) x (2.0/63.5) x (1000/8) = 10.5 cm^3

= 11 cm^3 (2 significant figures) ANS

(b) n(NO) = (2/3) x n(Cu) = (2/3) x (2.0/63.5)

V(NO) at STP = n(NO) x 22.4 dm^3 = (2/3) x (2.0/63.5) x 22.4

= 0.47 dm^3 (2 s.f.) ANS

(c) The oxidation number of Cu has changed from 0 to +2 and the oxidation number of N has changed from +5 to +2.

9. (a) $n(H_2)$ = PV/RT = 10^6 x 10/RT and n(He) = PV/RT = 5 x 10^5 x 5/RT

= 10^7/RT = 2.5 x 10^6/RT

Pressure in B = nRT/V

= 1.25 x 10^7/RT x RT/5

= 2.5 x 10^6 Pa ANS

(b) Pressure in A = nRT/V = (1.25 x 10^7/100R) x (200R/10)

= 2.5 x 10^6 Pa ANS

10. (a) base - proton acceptor (b) neither- no transfer of protons
(c) acid - proton donor (d) neither - no transfer of protons
(e) base - proton acceptor (f) neither - no transfer of protons

11. (a) -2 (b) +6 (c) +4 (d) 0 (e) +6 (f) +2 (g) -4 (h) +4
(i) -3 (j) 0

12. (a) $1s^2\ 2s^2\ 2p^2$
(b) alkanes or alkenes or alkynes
(c) (1) ETHANE
six hydrogen atoms arranged tetrahedrally around
two carbon atoms linked by a single covalent bond.

(2) PROPANE
eight hydrogen atoms arranged tetrahedrally around
three carbon atoms linked by single covalent bonds.

(3) n-BUTANE
ten hydrogen atoms arranged tetrahedrally around
four carbon atoms linked in a line by single covalent bonds.

(d) (1) methane (2) ethene (3) carbon dioxide

(4) ethyne (acetylene)

END OF 1988 CHEMISTRY YEAR 11 TRIAL EXAM SOLUTIONS

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX: (03) 9817 4334